



Software For Tracking Low Orbit Satellites

**Orbitron
Ham Radio Deluxe
Satélite Tracker
(iPhone/iPod App)**

Overview

- Amateurs have been building satellites since the earliest days of space travel.
- These satellites are known as “OSCARs”—Orbiting Satellite Carrying Amateur Radio.
- The first Amateur Radio satellite was OSCAR 1 and it reached orbit in 1961

Satellite Orbits

- **Most Amateur Radio satellites travel in low Earth orbits at altitudes of 500 to 950 mi.**
- **At this altitude, a satellite completes one orbit every 90 to 100 minutes.**
- **At the same time, the Earth is turning beneath the satellite.**
- **The result is that all stations on the ground will enjoy several 15-minute communication sessions with each satellite each day.**

Station Equipment

- Because of the low orbits and sensitive receivers, many Amateur Radio satellites can be used with simple equipment



AE5BK

09/08/2023




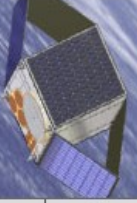
Tracking Programs

- A Tracking Program Utilizes Keplerian Data to Compute the Position and Velocity of a satellite for any given time:
 - Antenna aiming for azimuth and elevation
 - Doppler Shift Correction Based Upon Relative Velocity of the satellite to the Observer
- Future predictions of when a ground station will be in view of a satellite

Keplerian Data

- “Keps” are the variables which describe a Satellite’s Orbit
- Keps are developed by NORAD/NASA
 - AMSAT provides reformatted data
- Keps are distributed worldwide
 - Packet Bulletin Boards
 - BBS (DRIG, NASA, AMSAT BBS’s
 - Web Sites (www.amsat.org)
 - Automatic e-mail receipt from
 - keps@amsat.org
 - Publications (AMSAT Journal, OSR)

Which Satellites Are Active?

**AMSAT™**

850 Sligo Ave. Suite 600
Silver Spring, MD 20910
1-888-322-6728

Satellite Status

Launch Pad | Navigator | Sat Status | Keps | Passes | News | Store | Members | Contact Us | Return

Operational OSCAR Satellite Status Summary

[All OSCAR Satellites](#) | [Future Satellites](#) | [Satellite Frequencies](#) | [Satellite Chronology](#)

Operational [▲] | Semi-Operational [▶] | Non-Operational [▼] | Future Launch [▲] | Unknown [?]

| Name | Beacons | HF | VHF | UHF | L-Band | S-Band | C-Band | X-Band | K-Band | APRS | Packet | Schedule |
|---------------------------|---------|----|-----|-----|--------|--------|--------|--------|--------|------|--------|---|
| HO-68 | ▲ | | ▲ | ▲ | | | | | | | ▲ | Commissioning |
| ITUpSAT1 | ▲ | | | ▲ | | | | | | | | ITU Space Systems Lab |
| UWE-2 | | | | ▼ | | | | | | | | UWE-2 Website |
| BEESAT | | | | ▲ | | | | | | | | T.U. Berlin |
| SwissCube | | | | ▲ | | | | | | | | EPFL Swissscube website |
| SO-67 | ▼ | | ▲ | ▲ | | | | | | | | Activation Schedule |
| Castor | ▲ | | ▲ | | | | | | | | | Castor Webpage |

<http://www.amsat.org/amsat-new/satellites/status.php>

Orbitron 3.71



Orbitron 3.71

(C) 2001-2005 by Sebastian Stoff

www.stoff.pl

sebastian@stoff.pl

18.6788 E, 53.0279 N

Orbitron is Cardware!
See help for details.

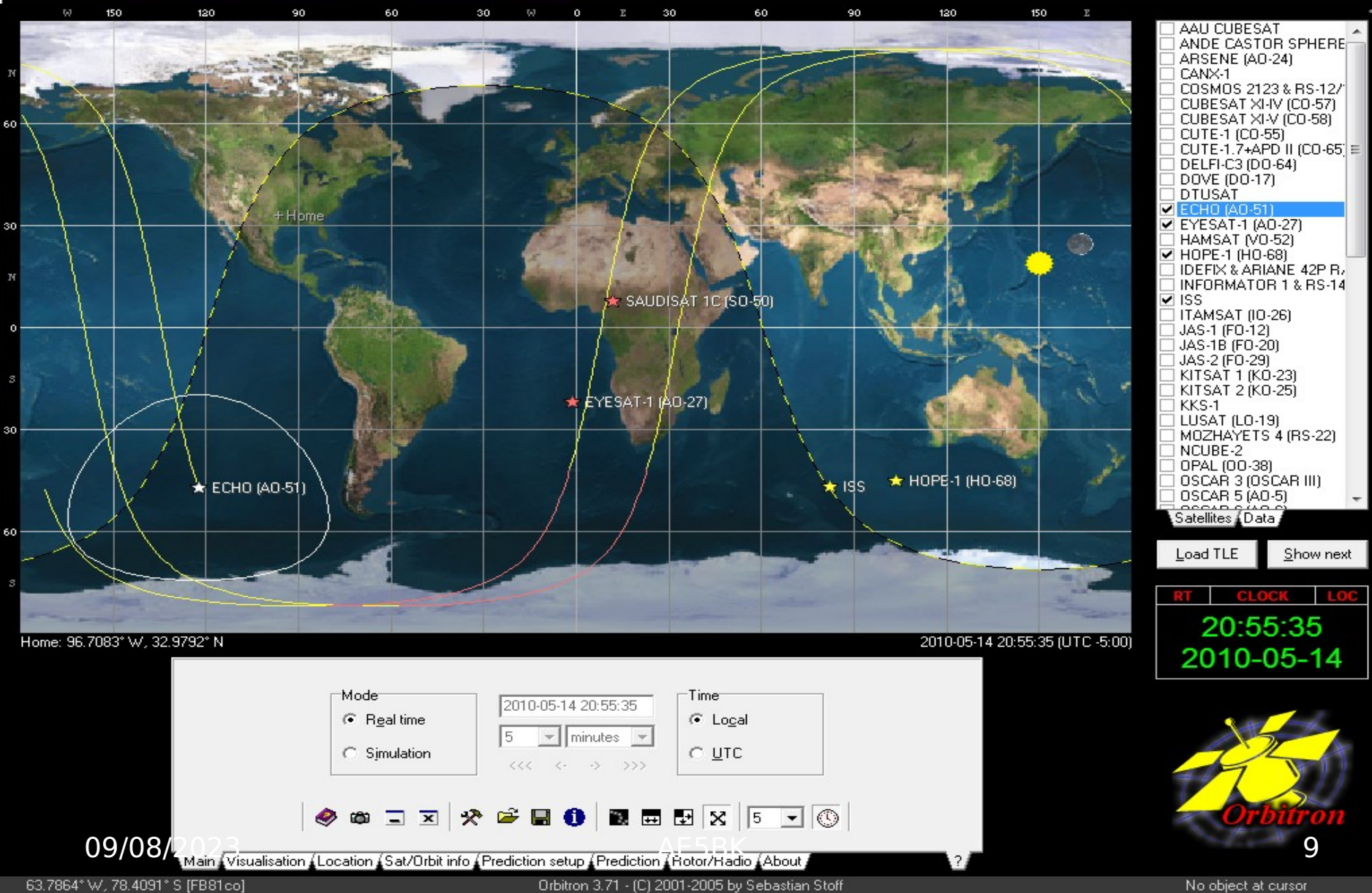
Sebastian Stoff

ul. Dziewulskiego 36a/52

87-100 Torun, POLAND

Main / Visualisation / Location / Sat/Orbit info / Prediction setup / Prediction / Rotor/Radio / About

Main Viewing Screen



Main Control Panel

Mode

☒ Real time

☐ Simulation

2010-05-14 21:04:58

5 minutes

<<< < - > >>>

Time

☒ Local

☐ UTC



Main / Visualisation / Location / Sat/Orbit info / Prediction setup / Prediction / Rotor/Radio / About

Setup Window

Setup Window (General)

Setup

General | World map | TLE updater | Time synch | Miscellaneous | Extra

RA/Decl output

☐ 0,0000°

☒ 0h(°) 00' 00"

Lon/Lat output

☒ 0,0000°

☐ 0° 00' 00"

Local time

UTC -5:00

- Auto +

☒ Autodetect

Behaviour

☒ Check for new version and messages

☒ TLE update confirmation

☒ Save profile on exit

☒ Exit confirmation

Date

Format

YYYY MM DD

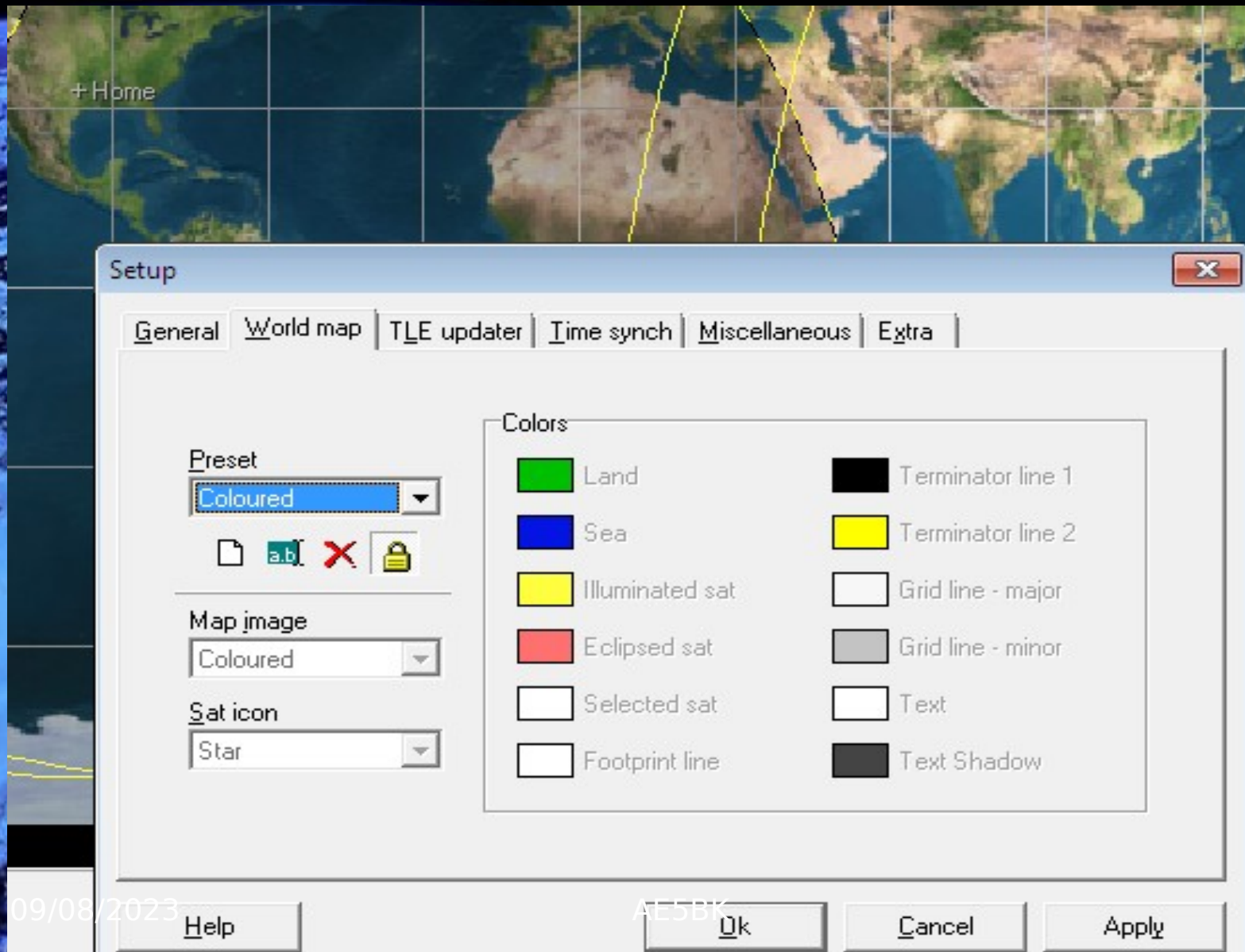
Separator

- dash

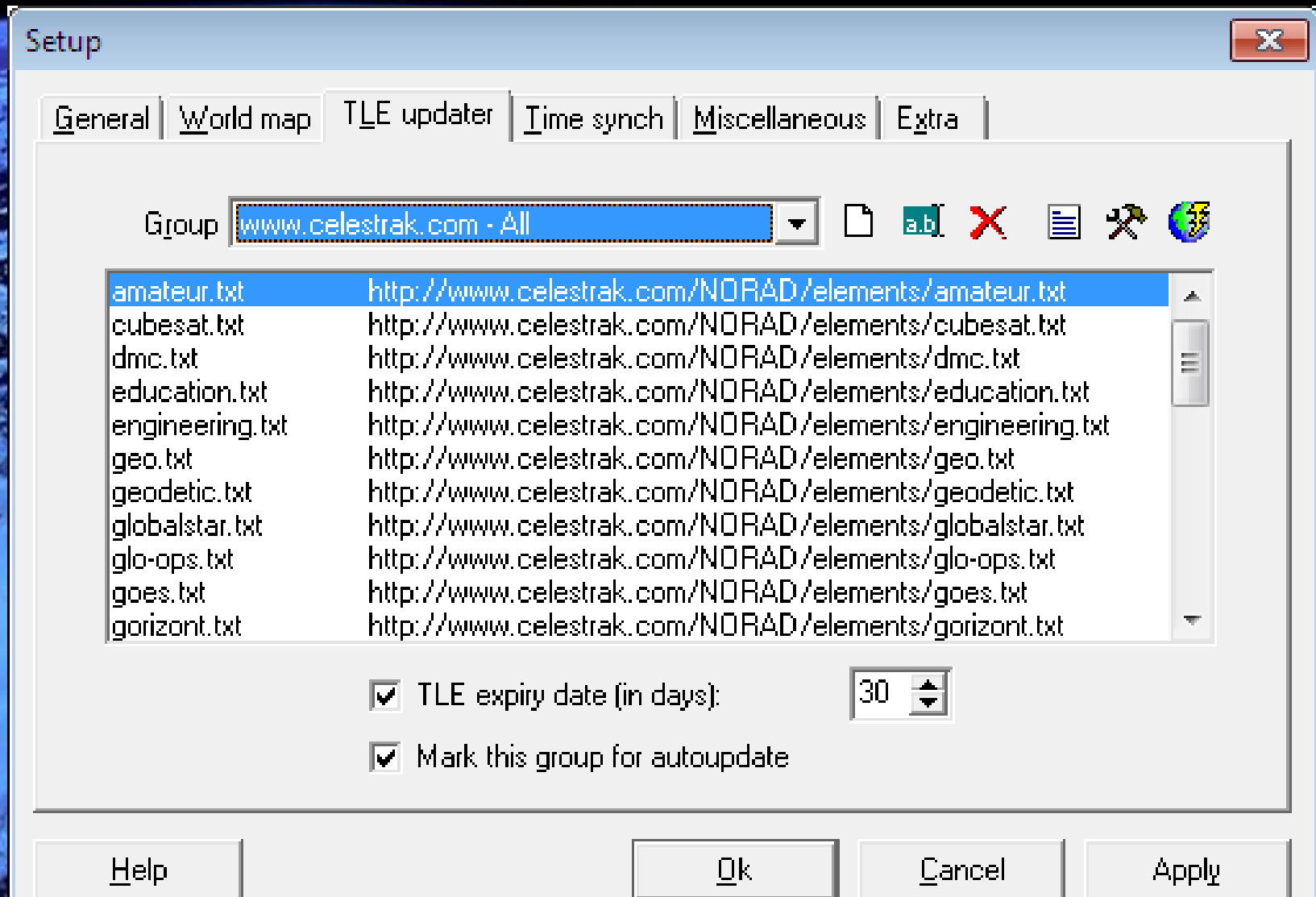
Example: 2003-01-30

Help Ok Cancel Apply

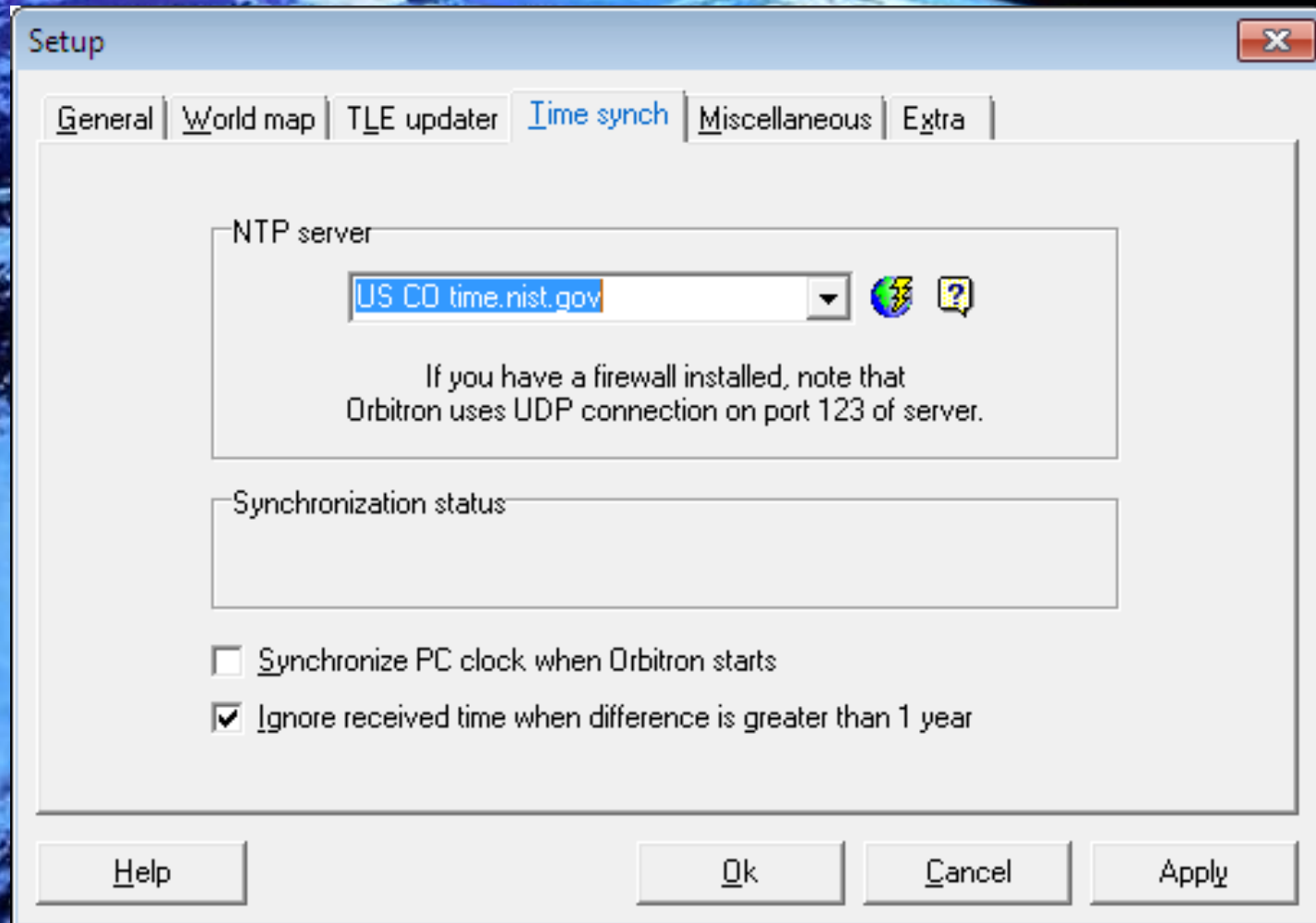
Setup Window (World Map)



Setup Window (TLE Location)



Setup Window (Time Sync)



Setup

General | World map | TLE updater | Time sync | Miscellaneous | Extra

NTP server

US CD time.nist.gov

If you have a firewall installed, note that Orbitron uses UDP connection on port 123 of server.

Synchronization status

☐ Synchronize PC clock when Orbitron starts

☒ Ignore received time when difference is greater than 1 year

Help Ok Cancel Apply

Setup Window (Misc)

Setup

General | World map | TLE updater | Time synch | **Miscellaneous** | Extra

Radar viewport

Radar background image
iridium

0 Radar viewport rotation

☐ Invert E-W directions on radar

AOS notification

0 Satellite elevation limit (deg)

☒ Show notice

☒ Play sound

Data\Snd_01.wav

Language

* English (Default)

Your language is NOT on list?
Become an Orbitron translator!

Personalization

☐ User working directory

☐ Personal TLE directory

Help Ok Cancel Apply

Setup Window (Extra)

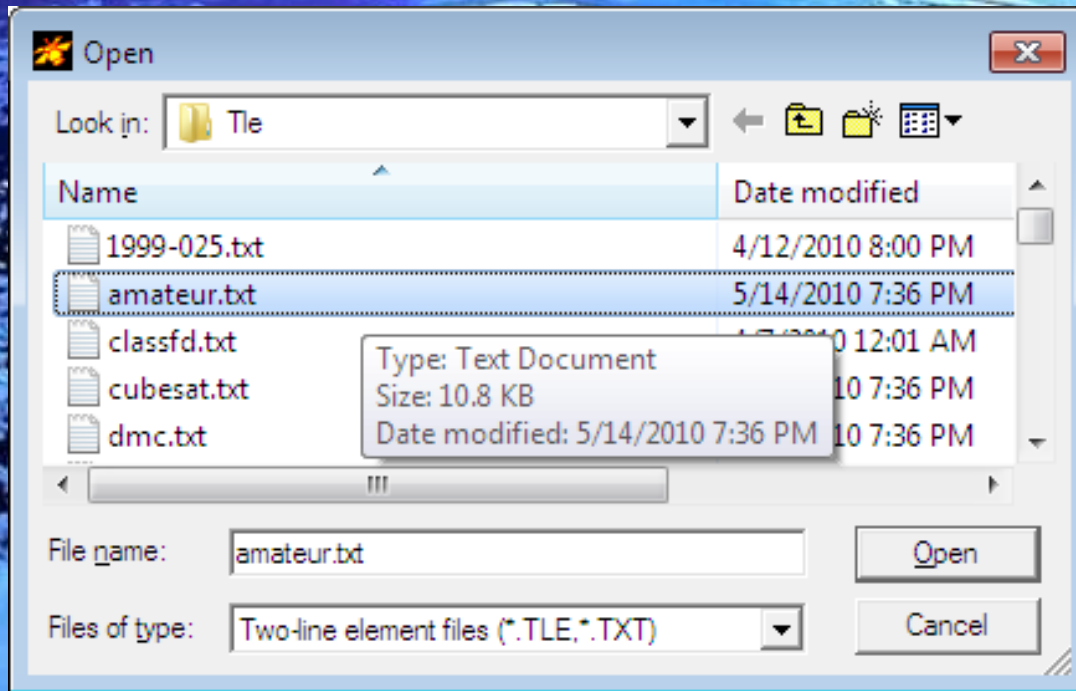
Setup

General | World map | TLE updater | Time synch | Miscellaneous | **Extra**

| | |
|--|---|
| <input checked="" type="checkbox"/> Save extended map settings | <input checked="" type="checkbox"/> Show application hints |
| <input checked="" type="checkbox"/> Save extended interface settings | <input type="checkbox"/> Hide '?' tab from bottom panels |
| <input checked="" type="checkbox"/> Full interactive mode for viewport | <input type="checkbox"/> Moon rotation for southern hemisphere |
| <input checked="" type="checkbox"/> Automatic 'Sat on track' position | <input type="checkbox"/> Degree symbol for Big5 charset |
| <input type="checkbox"/> Default mouse cursor | <input type="checkbox"/> Printer: Don't use highlight |
| <input checked="" type="checkbox"/> High resolution ground/sky track | <input type="checkbox"/> Printer: Use raw output |
| <input type="checkbox"/> Use default direction letters (N E S W) | <input checked="" type="checkbox"/> ScrSaver: Turn back time if TLE expired |
| <input type="checkbox"/> Image exporter / auto screen shot | <input type="checkbox"/> Autostart Rotor/Radio driver |
| <input checked="" type="checkbox"/> JPEG format for screen shots | <input type="checkbox"/> ADS Notification: Make satellite active |

Help Ok Cancel Apply

Satellite Setup



- ☐ AAU CUBESAT
- ☐ ANDE CASTOR SPHERE
- ☐ ARSENE (AO-24)
- ☐ CANX-1
- ☐ COSMOS 2123 & RS-12/
- ☐ CUBESAT XI-IV (CO-57)
- ☐ CUBESAT XI-V (CO-58)
- ☐ CUTE-1 (CO-55)
- ☐ CUTE-1.7+APD II (CO-65)
- ☐ DELFI-C3 (DO-64)
- ☐ DOVE (DO-17)
- ☐ DTUSAT
- ☒ ECHO (AO-51)
- ☒ EYESAT-1 (AO-27)
- ☐ HAMSAT (VO-52)
- ☒ HOPE-1 (HO-68)
- ☐ IDEFIX & ARIANE 42P R,
- ☐ INFORMATOR 1 & RS-14
- ☒ ISS
- ☐ ITAMSAT (IO-26)
- ☐ JAS-1 (FO-12)
- ☐ JAS-1B (FO-20)
- ☐ JAS-2 (FO-29)
- ☐ KITSAT 1 (KO-23)
- ☐ KITSAT 2 (KO-25)
- ☐ KKS-1
- ☐ LUSAT (LO-19)
- ☐ MOZHAYETS 4 (RS-22)
- ☐ NCUBE-2
- ☐ OPAL (OO-38)
- ☐ OSCAR 3 (OSCAR III)
- ☐ OSCAR 5 (AO-5)
- ☐ OSCAR 6 (AO-6)

Satellites Data

Two Line Element

Load TLE

Show next

Foot Print & Radar View



Location Tab

Name
AE5BK

Sign Home Grid locator EM12px Altitude (m) 0.0

Longitude 96.7083° W Latitude 32.9792° N **Choose**

Add to list Update Remove Clear list

<<< World >>>

AE5BK
Adoni
AE5BK
Agartala
Agra
Aguascalientes

Main Visualisation Location Sat/Orbit info Prediction setup Prediction Rotor/Radio About ?

Sat/Orbit Information Tab

ECHO (AO-51)

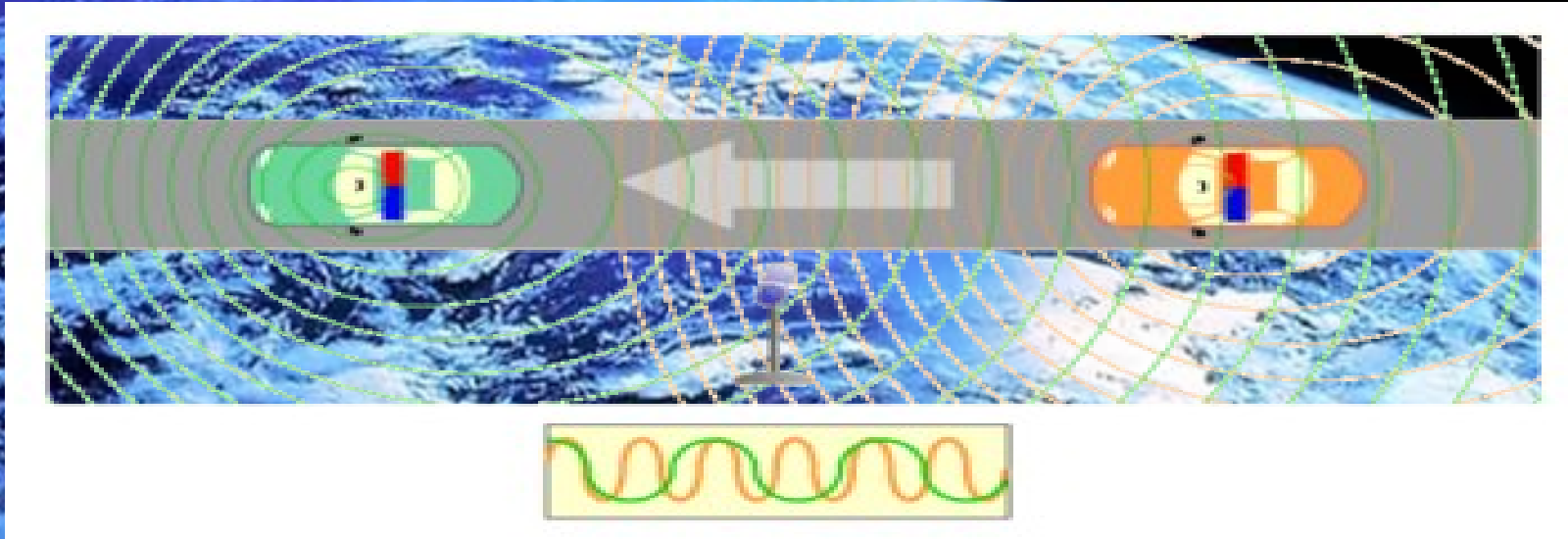
| | |
|-------------------|---------------------|
| Name | ECHO (AO-51) |
| NORAD # | 28375 |
| COSPAR designator | 2004-025-K |
| Epoch (UTC) | 2010-05-13 00:08:35 |
| Orbit # at Epoch | 30844 |
| Inclination | 98.062 |
| RA of A. Node | 128.509 |

NAME: AO-51 Phase 3E
LAUNCHED: 2004/06/29@06:30 UTC
SITE: Baikonur Cosmodrome
STATUS: Testing
MODE: FM Repeater, V/U, DN - 9k6 Digital, V/U,
PBP BBS, OPEN for Users
DNLINK: 435.300 FM Voice
DNLINK: 435.150 FM Digital 9600 bps PBP

Main / Visualisation / Location / Sat/Orbit info / Prediction setup / Prediction / Rotor/Radio / About

?

Doppler Effect



A stationary microphone records moving police sirens at different pitches depending on their relative direction.

Doppler Effect

What does that mean for us?

SAUDISAT 1C (SO-50)

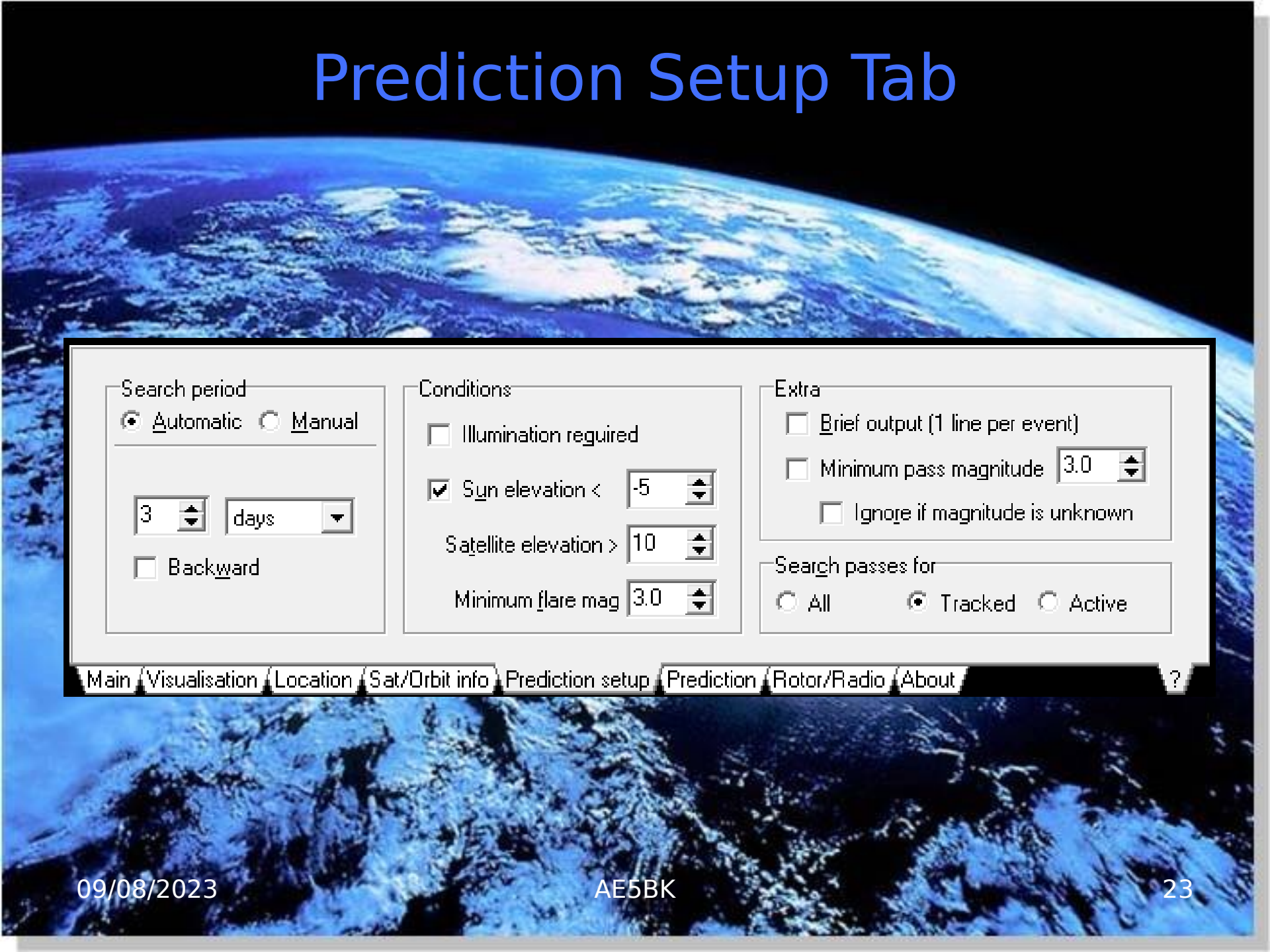
| | |
|---------------------|--|
| SAUDISAT 1C (SO-50) | NAME: SAUDISAT 1C SO-50 |
| 058-C | LAUNCHED: 2002/12/20 |
| 05-13 00:13:25 | SITE: Baikonur Cosmodrome via a converted Scud |
| | ballistic missile. |
| | STATUS: Operational |
| | DNLINK: 436.795 NFM |
| | UPLINK: 145.850 NFM 67.0 Hz PL tone |
| | UPDATE: 2004/07/31 |

Transmitted
Frequency

Enter 5 Memory Locations for Downlink

- #1 = 436.805 (Up 10 KHz)
- #2 = 436.800 (Up 5 KHz)
- #3 = 436.795 (Transmitted Frequency)
- #4 = 436.790 (Down 5 KHz)
- #5 = 436.785 (Down 10 KHz)

Prediction Setup Tab



The screenshot shows a software interface for setting up predictions, overlaid on a satellite image of Earth. The interface is divided into three main sections: Search period, Conditions, and Extra. At the bottom, there is a navigation bar with several tabs, and a help icon (?) is visible on the right.

Search period

☒ Automatic ☐ Manual

3 days

☐ Backward

Conditions

☐ Illumination required

☒ Sun elevation < -5

Satellite elevation > 10

Minimum flare mag 3.0

Extra

☐ Brief output (1 line per event)

☐ Minimum pass magnitude 3.0

☐ Ignore if magnitude is unknown

Search passes for

☐ All ☒ Tracked ☐ Active

Main / Visualisation / Location / Sat/Orbit info / **Prediction setup** / Prediction / Rotor/Radio / About / ?

Prediction

| Time - LOC | Satellite | Azm | Elv | Mag | Range | S.Azm | S.El |
|---------------------|----------------|-------|------|-----|-------|-------|-------|
| 2010-05-14 23:18:13 | ISS | 281.2 | 10.0 | ecl | 1326 | 325.4 | -30.2 |
| 2010-05-14 23:20:29 | ISS | 231.1 | 19.9 | ecl | 891 | 325.9 | -30.5 |
| 2010-05-14 23:22:44 | ISS | 180.9 | 10.1 | ecl | 1316 | 326.5 | -30.7 |
| 2010-05-14 23:29:06 | HOPE-1 (HO-68) | 203.2 | 10.1 | ecl | 3125 | 328.0 | -31.5 |
| 2010-05-14 23:35:12 | HOPE-1 (HO-68) | 262.4 | 30.2 | ? | 1990 | 329.5 | -32.1 |
| 2010-05-14 23:41:20 | HOPE-1 (HO-68) | 221.0 | 10.0 | ? | 3127 | 328.1 | -31.5 |

Passes

Flares

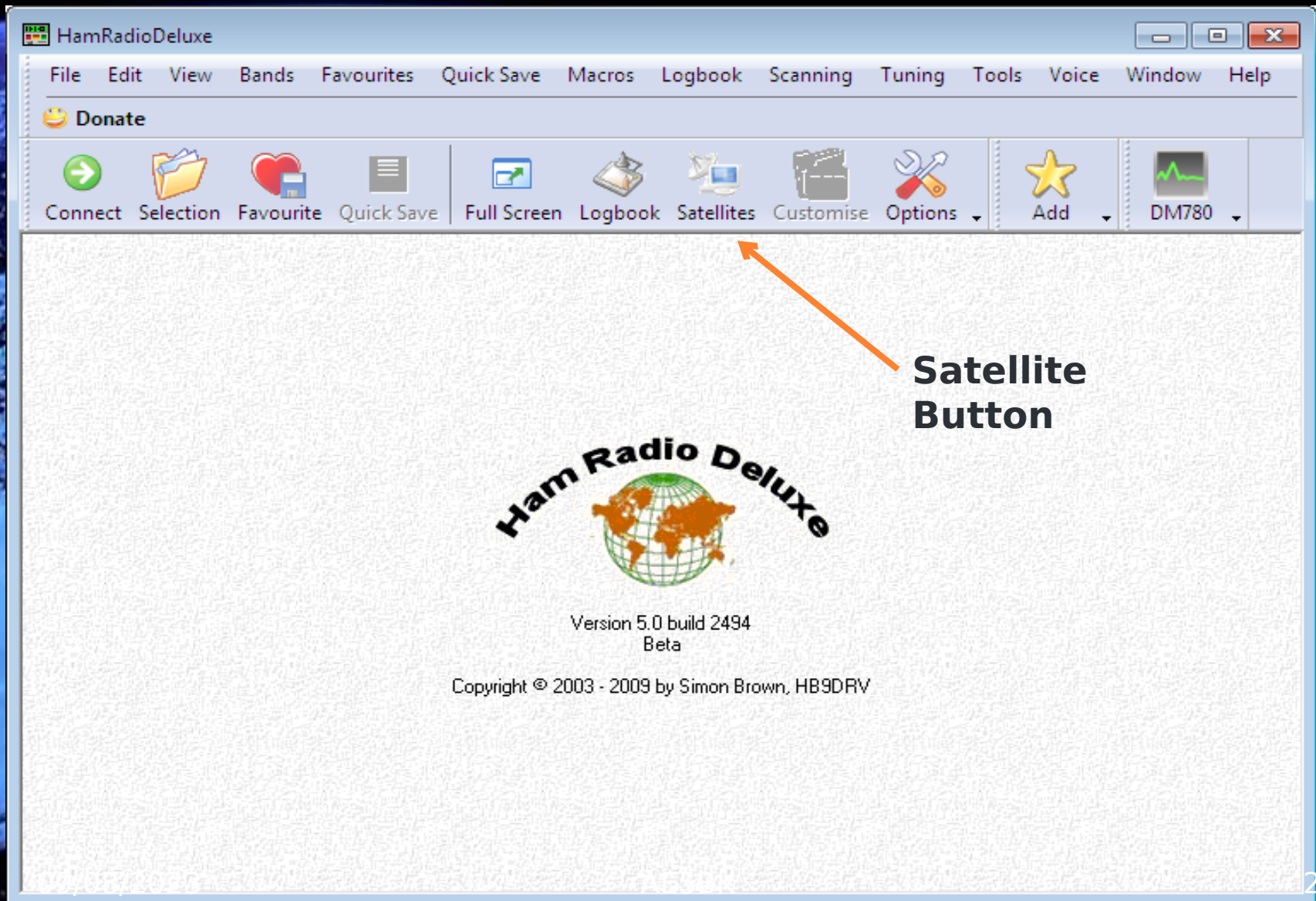
Predict



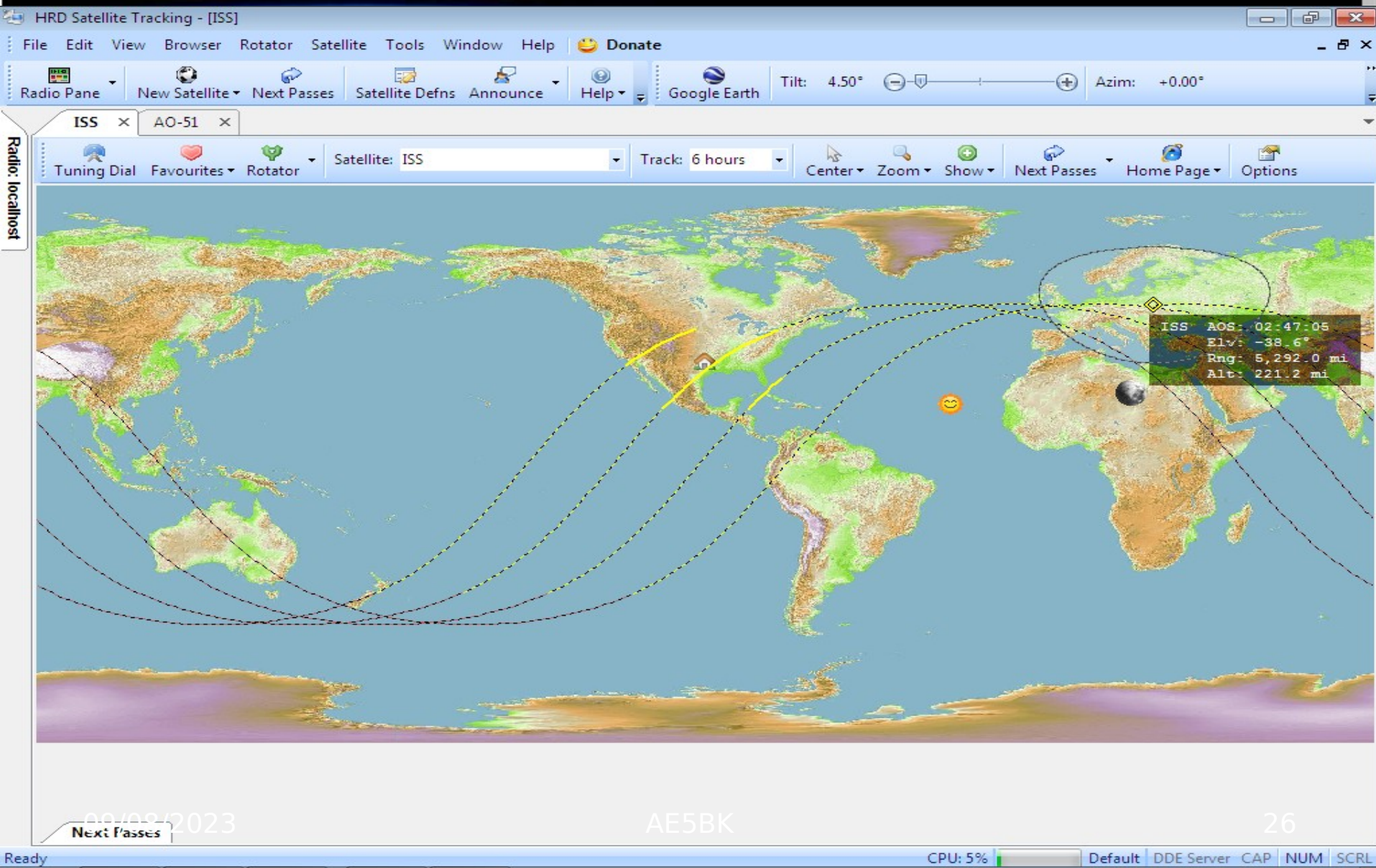
Main / Visualisation / Location / Sat/Orbit info / Prediction setup / Prediction / Rotor/Radio / About

?

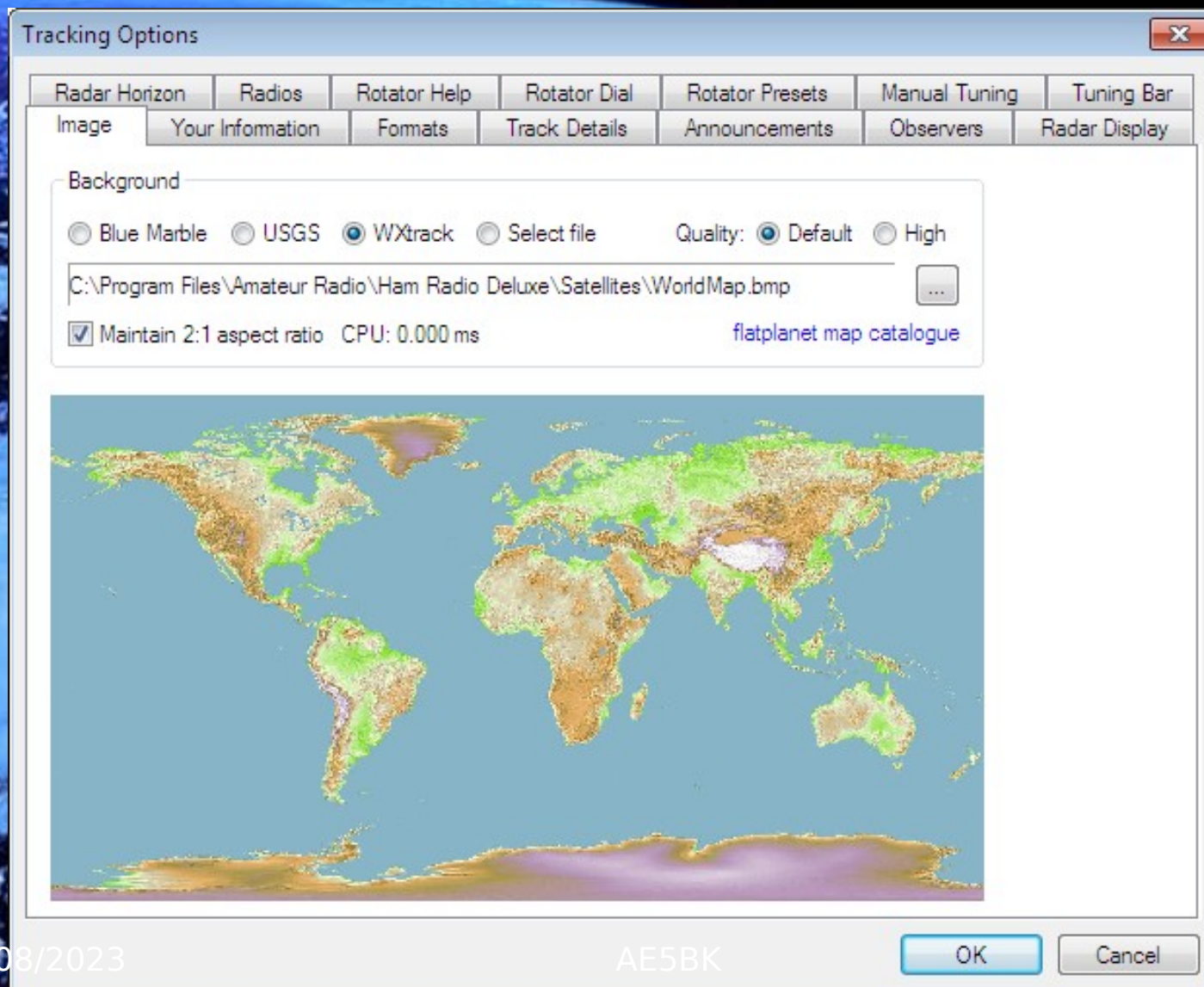
Ham Radio Deluxe



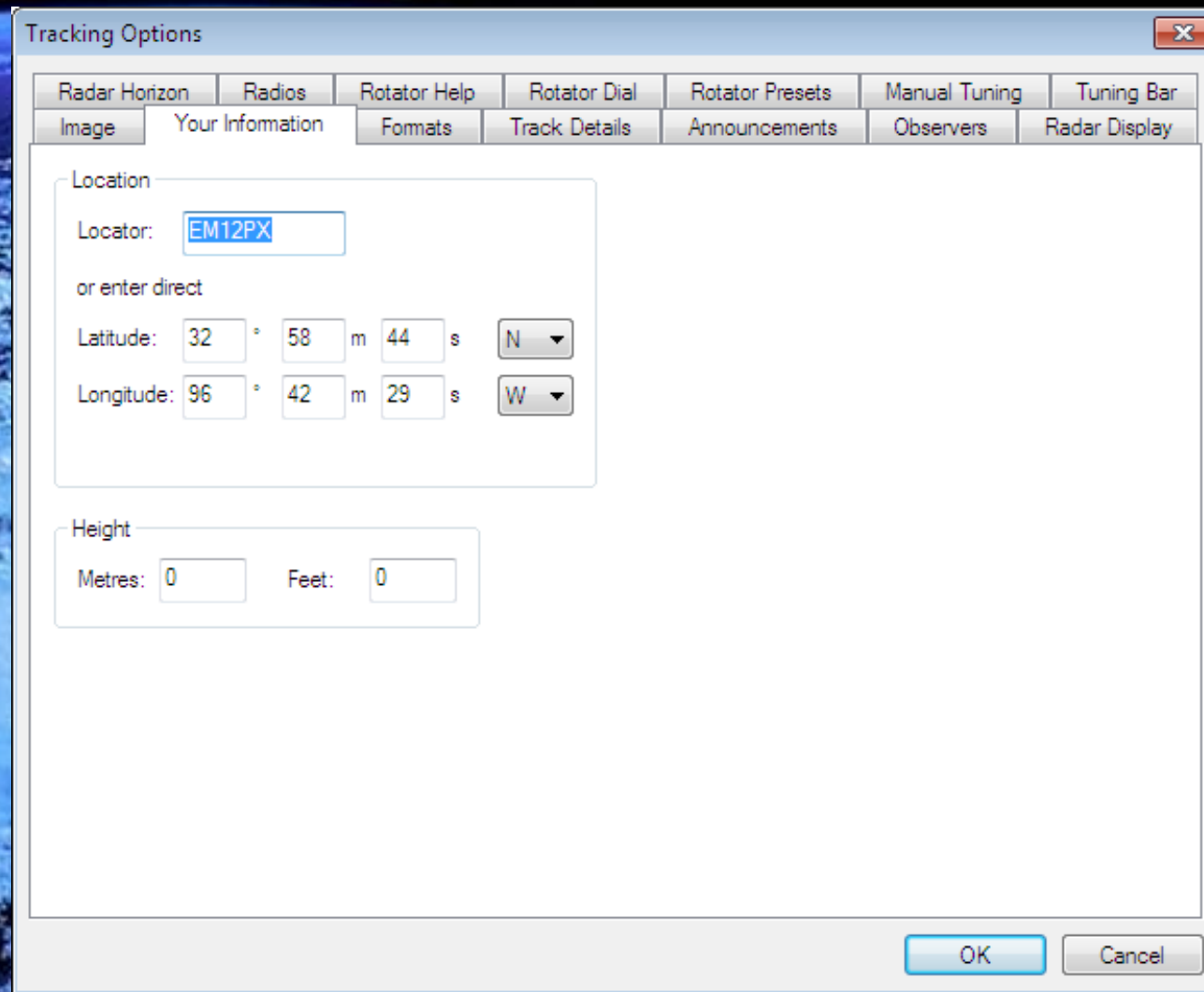
Main Control Panel



Tracking Options (Image)



Setting Your Location



The image shows a 'Tracking Options' dialog box overlaid on a background of Earth from space. The dialog box has a title bar with a close button. Below the title bar is a row of tabs: 'Radar Horizon', 'Radios', 'Rotator Help', 'Rotator Dial', 'Rotator Presets', 'Manual Tuning', and 'Tuning Bar'. Below these is another row of tabs: 'Image', 'Your Information', 'Formats', 'Track Details', 'Announcements', 'Observers', and 'Radar Display'. The 'Your Information' tab is selected. Inside the dialog, there are two main sections: 'Location' and 'Height'. The 'Location' section has a 'Locator' text box containing 'EM12PX', followed by the text 'or enter direct'. Below this are fields for 'Latitude' (32° 58' 44" N) and 'Longitude' (96° 42' 29" W). The 'Height' section has 'Metres' and 'Feet' text boxes, both containing '0'. At the bottom right are 'OK' and 'Cancel' buttons.

Tracking Options

Radar Horizon Radios Rotator Help Rotator Dial Rotator Presets Manual Tuning Tuning Bar

Image Your Information Formats Track Details Announcements Observers Radar Display

Location

Locator: EM12PX

or enter direct

Latitude: 32 ° 58 m 44 s N

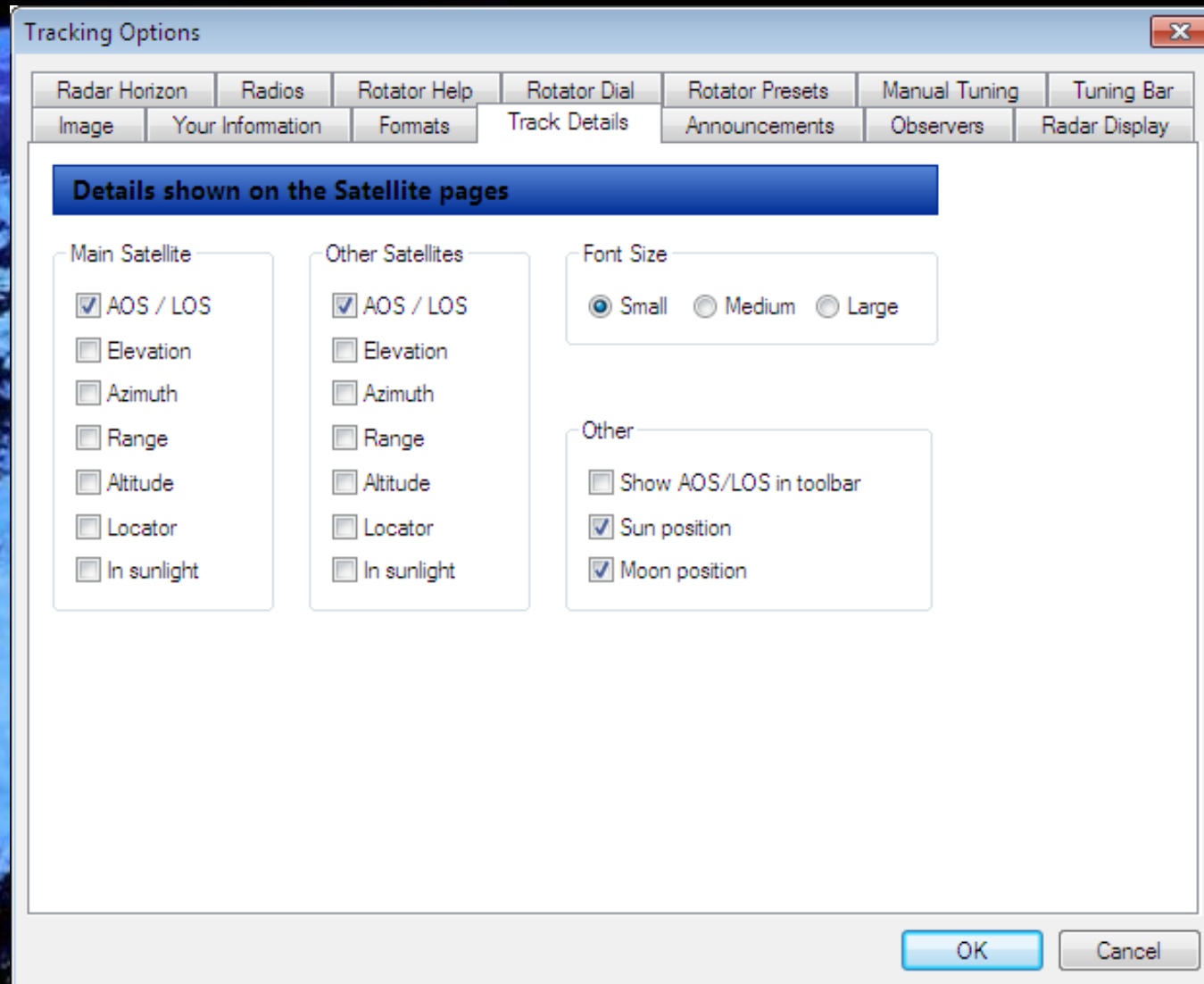
Longitude: 96 ° 42 m 29 s W

Height

Metres: 0 Feet: 0

OK Cancel

Tracking Details



The image shows a 'Tracking Options' dialog box overlaid on a background of Earth from space. The dialog box has a title bar with a close button. Below the title bar is a tabbed interface with two rows of tabs. The 'Track Details' tab is selected. The main content area has a blue header 'Details shown on the Satellite pages'. It contains three groups of settings: 'Main Satellite', 'Other Satellites', and 'Font Size'. Each group has a list of checkboxes. The 'Font Size' group has radio buttons. The 'Other' group has three checkboxes. At the bottom right are 'OK' and 'Cancel' buttons.

Tracking Options

Radar Horizon Radios Rotator Help Rotator Dial Rotator Presets Manual Tuning Tuning Bar
Image Your Information Formats **Track Details** Announcements Observers Radar Display

Details shown on the Satellite pages

Main Satellite

- ☒ AOS / LOS
- ☐ Elevation
- ☐ Azimuth
- ☐ Range
- ☐ Altitude
- ☐ Locator
- ☐ In sunlight

Other Satellites

- ☒ AOS / LOS
- ☐ Elevation
- ☐ Azimuth
- ☐ Range
- ☐ Altitude
- ☐ Locator
- ☐ In sunlight

Font Size

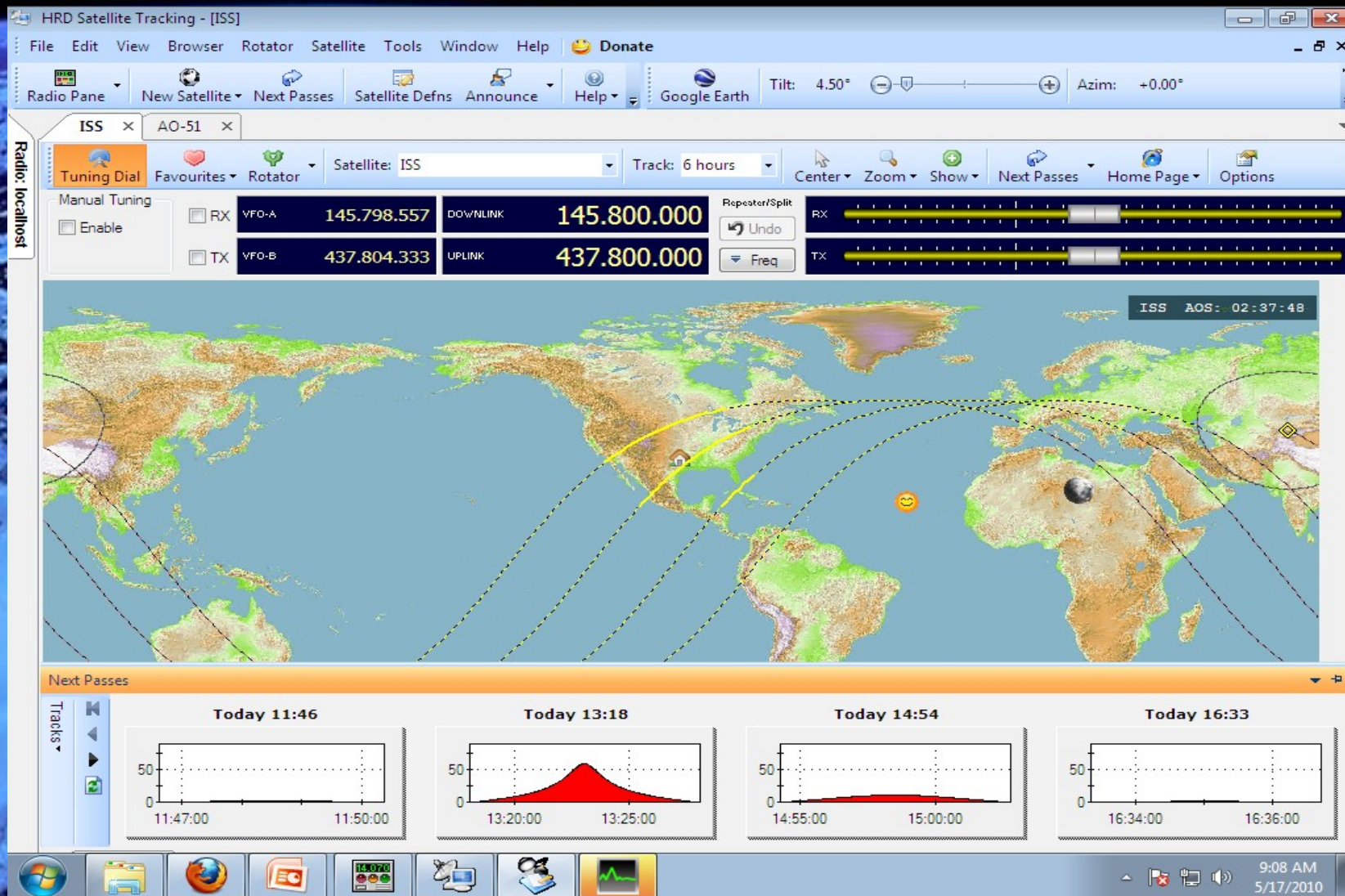
☒ Small ☐ Medium ☐ Large

Other

- ☐ Show AOS/LOS in toolbar
- ☒ Sun position
- ☒ Moon position

OK Cancel

Tuning Dial



Satellite Defns & Favorites

New Satellite ▾ Next Passes Satellite Defns Announce Help ▾ Google Earth Tilt: 0.00°

Satellite Definitions

Modify Delete Enable All Enable None Add Group Modify Group Delete Group Favourites Hon

Current Satellite Definitions - used in Tracking windows

| Enable | Name / | Catalog | Favourites | Home Pages |
|-------------------------------------|----------------|---------|------------|------------|
| <input type="checkbox"/> | AAU CUBESAT | 27846 | — | — |
| <input type="checkbox"/> | AAUSAT2 | 32788 | — | — |
| <input type="checkbox"/> | AEROCUB3 | 35005 | — | — |
| <input type="checkbox"/> | AO-07 | 07530 | 6 | 1 |
| <input type="checkbox"/> | AO-16 | 20439 | | |
| <input checked="" type="checkbox"/> | AO-27 | 22825 | | |
| <input checked="" type="checkbox"/> | AO-51 | 28375 | | |
| <input type="checkbox"/> | ARSENE (AO-24) | 22654 | | |
| <input type="checkbox"/> | CANX-1 | 27847 | | |
| <input type="checkbox"/> | CANX-2 | 32797 | | |
| <input type="checkbox"/> | CAPE1 | 31130 | | |
| <input type="checkbox"/> | CASTOR | 35694 | | |
| <input type="checkbox"/> | CO-55 | 27844 | | |
| <input type="checkbox"/> | CO-56 | 28941 | | |
| <input type="checkbox"/> | CO-57 | 27848 | | |
| <input type="checkbox"/> | CO-58 | 28895 | | |
| <input type="checkbox"/> | CO-65 | 32785 | | |

New Satellite ▾ Next Passes Satellite Defns Announce Help ▾ Google Earth

Satellite: ISS Track: 6 hours Center ▾ Zoom

144.487.852 DOWNLINK 144.490.000

Beacon / RX only: 144.490.000 (SSTV)

Repeater / Split: 145.800.000:144.490.000 (Crew Contact f...)

Repeater / Split: 145.800.000:145.200.000 (Crew Contact f...)

Repeater / Split: 145.800.000:437.800.000 (FM voice repea...)

AMSAT

ARISS

iPhone/iPod App



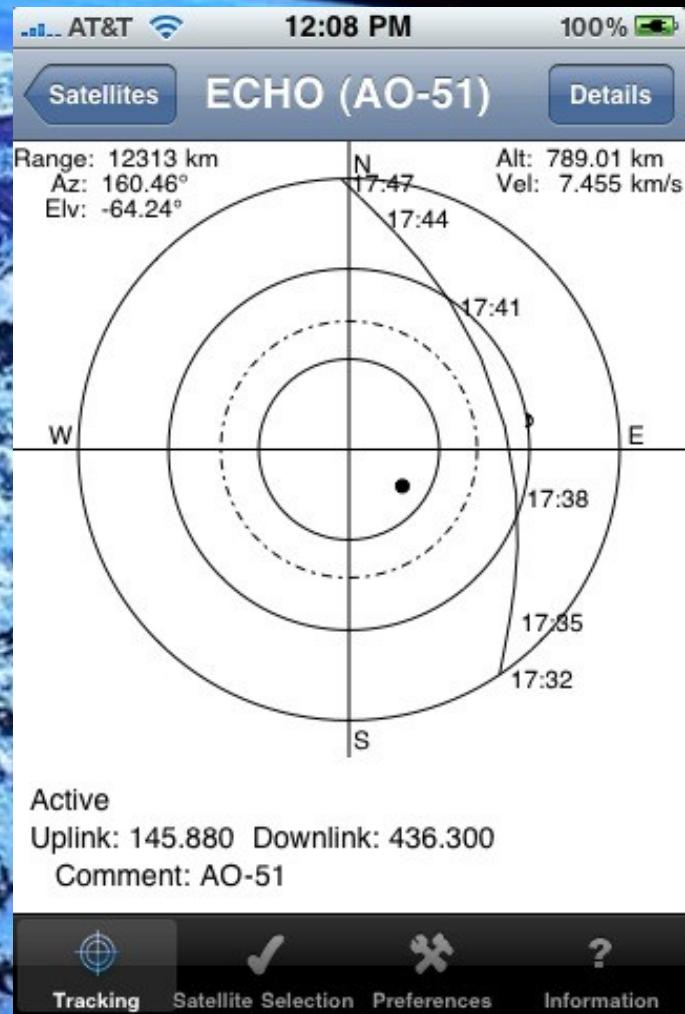
Satellite List

A screenshot of a mobile application interface for satellite tracking. The background is a high-resolution image of Earth from space, showing swirling cloud patterns and the curvature of the planet. The app's status bar at the top shows 'AT&T' as the carrier, a full Wi-Fi signal, the time '12:08 PM', and a 100% battery level. The app's header is a dark grey bar with a green download arrow icon on the left, the title 'Satellites' in the center, and an 'Edit' button on the right. Below the header is a list of satellites. Each list item consists of the satellite name in bold, its 'AOS' (Acquisition of Signal) time, and the time remaining until AOS. To the right of each item is a chevron icon. The list includes: ISS (ZARYA), EYESAT-1 (AO-...), ECHO (AO-51), HOPE-1 (HO-68), SUMBANDILA..., and SAUDISAT 1C... Below the list are two empty rows. At the bottom is a dark grey navigation bar with four icons: a target (Tracking), a checkmark (Satellite Selection), a wrench (Preferences), and a question mark (Information).

| Satellites | | Edit |
|-------------------|--------------------------|------|
| ISS (ZARYA) | AOS: 13:18:23 in 1:10 | > |
| EYESAT-1 (AO-...) | AOS: 13:35:51 in 1:27 | > |
| ECHO (AO-51) | AOS: 17:32:01 in 5:23 | > |
| HOPE-1 (HO-68) | AOS: 12:11:51 in 0:03 | > |
| SUMBANDILA... | AOS: 21:24:10 in 9:16 | > |
| SAUDISAT 1C... | AOS: 16:42:33 in 4:34 | > |
| | | |
| | | |

Tracking Satellite Selection Preferences Information

Radar View



Detail Information

AT&T 12:08 PM 100%

ECHO (AO-51) ECHO (AO-51) Edit

Frequency Information

Uplink: 145.880 Downlink: 436.300
AO-51

Comments

AO-51

Future Passes

| | |
|---------------------|---------------------|
| AOS:17-May 17:32:01 | LOS:17-May 17:46:38 |
| Max Elevation: 37 ° | |
| AOS:17-May 19:11:22 | LOS:17-May 19:25:05 |
| Max Elevation: 21 ° | |
| AOS:18-May 05:44:53 | LOS:18-May 05:56:54 |
| Max Elevation: 16 ° | |

Tracking Satellite Selection Preferences Information

Pass Information

The screenshot shows a mobile application interface for tracking satellite passes. The status bar at the top indicates AT&T service, 12:28 PM, and 100% battery. The app header displays 'ECHO (AO-51)' and an 'Edit' button. Below the header, the satellite name 'AO-51' is shown in a white box. The main section is titled 'Future Passes' and contains a list of seven satellite passes. Each pass entry includes the Acquisition of Signal (AOS) and Loss of Signal (LOS) times, along with the maximum elevation angle. The bottom of the screen features a navigation bar with four icons and labels: Tracking, Satellite Selection, Preferences, and Information.

| AOS | LOS | Max Elevation |
|-----------------|-----------------|---------------|
| 17-May 17:32:01 | 17-May 17:46:38 | 37 ° |
| 17-May 19:11:22 | 17-May 19:25:05 | 21 ° |
| 18-May 05:44:53 | 18-May 05:56:54 | 16 ° |
| 18-May 07:23:03 | 18-May 07:36:41 | 39 ° |
| 18-May 16:54:00 | 18-May 17:06:37 | 16 ° |
| 18-May 18:31:08 | 18-May 18:46:13 | 52 ° |
| 19-May 06:43:33 | 19-May 06:57:36 | |

What is Next?

Now that I have every set what do I do now?

- **Go out & listen.**
- **Take a small recorder so that you can replay the session.**
 - **To learn what information is exchanged.**
 - **Who you make contact with. For Logging and QSO cards.**



Most important thing is
keep having
FUN

Sources of Information

- Books
- Periodicals
- Internet Sites
- BBS Sites
- AMSAT Area Coordinators
- AMSAT Resource Guide
(From AMSAT Web Site)

<http://www.amsat.org>



General Information Books

- **AMSAT: How to Use Amateur Radio Satellites**
- **AMSAT: Working the Easy Sats**
- **AMSAT: Mode S The Book**
- **ARRL: Handbook**
- **ARRL: Radio Amateur's Satellite Handbook**
- **ARRL: Satellite Anthology**

